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ORIGINAL ARTICLE

Relationship between eating disorders and internet and smartphone addiction in college students

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Purpose This study was planned and conducted to determine the relation between eating behavior disorder and smartphones and the internet in college students.
Methods This research was performed on a total of 437 college students, including 116 males and 321 females. A questionnaire questioning the general characteristics (age, sex, department, socioeconomic status, skipping meal, number of main meals and snacks in a day, sleeping duration, doing physical activity, height, and body weight) of students was used. In addition, Eating Attitude Test-40 (EAT-40), Young's Internet Addiction Scale, and Smartphone Addiction Scale were used to measure eating behavior disorders, internet addiction, and smartphone addiction, respectively. Height and body weight were measured in accordance with the method.
Results 12.6% of the students participating in the study were at risk for eating disorders. Female students had higher EAT-40 scores than male students. 13% of students had potential internet addiction. According to Pearson chi-square test, the prevalence of potential internet addiction (36.4%) in students with eating disorder was higher than those without eating disorder (9.7%) ($p<0.05$). Pearson correlation analyses displayed that Smartphone Addiction Test score associated positively with EAT-40 score ($r=0.277$) and Internet Addiction Test score ($r=0.665$) and students' body mass index (BMI) ($r=0.121$). In addition to these, students' duration of staying on the internet correlated with their BMI ($r=0.137$). Males had a higher rate of potential internet addiction than females (22.4% in males and 9.7% in females, respectively) ($p<0.05$).
Conclusion The present results suggest that students' duration of using the internet affects smartphone addiction and internet addiction, both of which influence eating behavior disorder. In addition, both smartphone and internet addiction and eating behavior disorder correlated positively and significantly with overweight.
Level of evidence Level V: cross-sectional descriptive study.

Keywords Addiction · Eating disorder · Internet · Smartphone

Introduction

Eating disorders are a condition characterized by abnormal patterns of eating behavior such as excessive restriction of food intake or binge eating and by the dislike of the body shape or weight, obsessively fear of becoming fat, and the desire to be thin [1]. The transition period to university is an important process in terms of obesity and overweight risk due to the emergence of some psychological problems such as eating disorders, and unhealthy diet, as well as changes and difficulties occurring in the lifestyle of individuals [2–4].

The internet is a global network with more accessible and more service areas today, suggesting that its usage is increasing rapidly in every age group. Although technology is recognized as a positive phenomenon, technology addiction increases a user's perception that the system is beneficial, which results in its excessive use in an unhealthy manner. Developments in mobile and wearable technologies especially in the recent years have played an important role in emerging the internet addiction by enabling individuals to connect to the internet wherever and whenever they want

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continuously [5]. Smartphones are one of the easiest ways to access the internet. With the ever-increasing number of their users worldwide (30.9%), smartphones are technological devices that can process more data than other phones and have many properties, such as navigation, internet access, and multimedia [6–8]. This brings about many problems due to its increasing popularity and excessive use [7]. It may be defined as smartphone addiction that a person does not want to be far from her/his own phone, but engages in the phone in such a way as to retard things to do in her/his daily life and experiences withdrawal when she/he is far from it [9]. Most of the university youth (94%) use smartphones resembling a mini-computer [10]. It is considered to be beneficial to have a smartphone among college students, but it has been well known that smartphone use is associated with increased anxiety, insomnia, lack of self-confidence, emotional imbalance and depression [11]. In addition, a study showed that smartphone addiction has negative effects on energy level, body weight, eating and exercise habits, and academic performance [12].

It has been found that computer and internet usage rate in Turkey was 55.9% in the 16–74 age individuals and 77% in the 16–24 age individuals with the highest usage rate. In addition, the rate of mobile phone usage is 96.9%. As young people use the internet and mobile phones the most in Turkey, it makes them a risky group in terms of smart phone and internet addiction [13].

Although several studies revealed that internet addiction is associated with eating disorders [14–16], no study addressing the relationship between smartphone addiction and eating disorders has existed in the literature. There is no information available in this arena and it is very important to fill the emptiness in knowledge and to supply evidence for the various stakeholders to make a conscious determination on appropriate public health interventions. Therefore, this research was planned and conducted to show the relation between smartphone addiction in addition to internet addiction and eating behavior disorders and anthropometric measurements.

Participants and method

Research method and sample selection

This survey was performed from March 2019 to June 2019 and involved six departments at a university in Turkey. This cross-sectional research was carried out on 437 college students. Of them, 116 were males and 321 were females. Their ages ranged from 19 to 29. The sample of this study was randomly selected among university students who were studying at the Faculty of Health Sciences, Gümüşhane University. After the study was clarified to them and students who volunteered gave written voluntary consent form. The primary inclusion criterion was being a smartphone user. In addition, being a university student, being between the ages of 19–29 was also among the inclusion criteria. Students with alcoholism and substance abuse, pregnant, or lactating at the time of this study, and any chronic or acute disease, such as diabetes, kidney disease, cardiovascular diseases, cancer, and thyroid disease were excluded from this study. They also were not included if they used any supplements or medication regularly. A questionnaire form was employed to determine the general characteristics of students' age, gender, department, housing status and socioeconomic status. In addition, questions about food consumption, such as the number of daily meals and the status of and reason for skipping a meal, about internet use such as the place where to connect to the internet, the most preferred sites on the internet, the frequency of visiting the internet cafe and the time spent on the internet, and about smartphone use, such as the year of using a smartphone, time spent on a smartphone daily and questions about the purpose of using a smartphone were asked students. Eating Attitudes Test-40 (EAT-40), Smartphone Addiction Scale (SAS) and Young's Internet Addiction Test (IAT) were used to measure eating disorders, smartphone addiction, and internet addiction, respectively. The number of samples was determined to be 428 students using power analysis method (95% confidence interval, 5% error level, 0.35 effect size) and 437 students were included in this study.

Anthropometric measurements

The body weight of the individuals was measured using the Tanita BC-418-MA device on an empty stomach and with thin clothing. Their height was measured using the Seca brand height measurement instrument while feet were flat and with heels almost together and head looked straight ahead with the Frankfurt plane. The body mass index (BMI) (kg/m^2) was calculated by dividing the body weight (in kilograms) by the square of height (in meters) and the result was evaluated according to the World Health Organization classification. According to this classification, students with a BMI of < 18.5 were underweight, those with a range of 18.5–24.9 were normal, those with a BMI of 25–29.9 were overweight, and those with a BMI of ≥ 30 were obese [17].

Eating attitudes test-40 (EAT-40)

The Eating Attitudes Test (EAT) improved by Garner and Garfinkel [18] was designed as a scale that evaluates anorexia and bulimia nervosa. Its validity and reliability were tested by Savaşır and Erol [19]. The answers given to questions vary from 1 = always to 6 = never, and scores equal to or higher than 30 have been accepted as having irregular

eating behavior [19]. The Cronbach Alpha value of the test was found to be 0.70 in Savaşır and Erol's study [19]. The Cronbach Alpha reliability coefficient was found to be 0.78 in this study.

Internet addiction test (IAT)

The Turkish version [20] of the Internet Addiction Test [21] was used to measure dysfunctional internet usage among adolescents and adults worldwide. The Internal consistency coefficient of this test was found to be 0.91 in Bayraktar's study [20]. The Cronbach Alpha reliability coefficient was found to be 0.90 in this study. This test contains 20 items that ask individuals to evaluate how often they show behaviors such as spending a lot of time on the internet, neglect of daily routines, disruption of academic or business performance, hiding time spent on the internet, sleep problems, depressive feelings that occur when social isolation and internet use are restricted, and failures to reduce internet use. Each item was scored from 1 (none) to 5 (always). Total scores range from 20 to 100, and 20–49 scores indicate normal internet use, and 50 and higher scores indicate potential internet addiction [16].

Smartphone addiction scale (SAS)

Smartphone Addiction Scale was improved by Known et al. [22]. It was adapted to Turkish by Demirci et al. [6] and its internal consistency coefficient was found to be 0.947. The Cronbach Alpha reliability coefficient was found to be 0.94 in this study. The scale uses a 6-point Likert type rating (1 = I strongly disagree, 6 = I strongly agree). The total score ranges from 33 to 198, and high scores show serious telephone addiction. No particular cutoff score was reported in both the original article and the Turkish version.

Statistical analysis

The data were analyzed using SPSS 23.0 package program. Numerical data are shown as mean and standard deviation ($x \pm ss$), and nominal data are displayed as numbers and percentages. The difference between the independent variables in the data showing normal distribution was tested with the help of the Independent Student t test, Mann Whitney U in the data without normal distribution, and Pearson Chi-square test in the categorical data. The relationship between the two groups in numerical data was tested with Pearson Correlation Analysis in the data showing normal distribution, and Spearman Correlation Analysis in those without normal distribution. $p < 0.05$ value was considered statistically significant.

Research ethics

Written approval form was signed by the students who agreed to participate in the study and Ethical Commission Approval numbered 2019/2 and dated 14.02.2019 was obtained from Gümüşhane University Ethics Commission.

Results

Demographics and anterior analyses

The data on the distribution of some variables (age, number of meals, grade point averages, sleep duration, etc.) of students according to gender and their media usage are shown in Table 1. The vast majority of students reported that they skipped a meal (53.3%). The number of main meals consumed was higher in males (2.3 ± 0.6 in males and 2.1 ± 0.5 in females, respectively) while the number of snacks was higher in females (1.2 ± 1.0 in males and 1.4 ± 1.0 in females, respectively) ($p < 0.05$). 49.1% of males and 19.7% of females were doing regular physical activity ($p < 0.05$).

35.7% of students thought to being addicted to smartphones while 97.3% of used mobile phones to connect to the internet. Most students (44.9%) used the smartphone to access social networks, and the purpose of using a smartphone was significantly different by gender. It was found that 74.9% of the students preferred social sharing sites on the internet and the sites preferred by female and male students were different from each other ($p < 0.05$).

Although the time to use the smartphone (h/day) and the time to stay on the internet (h/day) were not different between males and females, the time to use the computer on weekdays and weekends was significantly higher in males. The grade point average of male students (2.7 ± 0.4) was lower than that of female students (2.9 ± 0.4) ($p < 0.05$). The sleeping duration (h/day) of the students also differed according to gender, and the daily sleeping hours of the females were higher than the boys ($p < 0.05$) (Table 1).

Comparison of test scores by gender

EAT scores were significantly higher in female students than in male students (18.4 ± 10.8 in females and 15.3 ± 10.1 in males, respectively). Internet Addiction Test scores were significantly higher in male students (34.4 ± 19.3 in males and 28.9 ± 13.6 in females, respectively). It has been found that 13% of students were potential internet addiction and 12.6% were at risk of the eating disorder. 8.6% of males and 14.0% of females were at risk of the eating disorder and no significant difference existed according to gender. In addition to these, the

Table 1 Some general characteristics of students

	Male $n=116$ n (%)	Female $n=321$ n (%)	Total $n=437$ n (%)	p^{β}
Age (year) (Mean ± SD)	21.4 ± 1.8	20.5 ± 1.5	20.7 ± 1.6	
Skipping a meal[§]				
Yes	56 (48.3)	177 (55.1)	233 (53.3)	0.310
Sometimes	49 (42.2	110 (34.3)	159 (36.4)	
No	11 (9.5)	34 (10.6)	45 (10.3)	
Number of main meals /day (Mean ± SD)	2.3 ± 0.6	2.1 ± 0.5	2.1 ± 0.5	0.001*
Number of snacks /day (Mean ± SD)	1.2 ± 1.0	1.4 ± 1.0	1.3 ± 1.0	0.021*
Difficulty in falling asleep at night[§]				
Yes	57 (49.1)	163 (50.8)	220 (50.3)	0.762
No	59 (50.9)	158 (49.2)	217 (49.7)	
Grade point averages (Mean ± SD)	2.7 ± 0.4	2.9 ± 0.4	2.9 ± 0.4	0.000*
Sleeping duration (h/day) (Mean ± SD)	7.3 ± 1.6	7.6 ± 1.4	7.6 ± 1.4	0.019*
Doing regular physical activity[§]				
Yes	57 (49.1)	63 (19.7)	120 (27.5)	0.000*
No	59 (50.9)	258 (80.3)	317 (72.5)	
Most frequently used tool to access the internet[§]				
Computer	7 (6.0)	5 (1.6)	12 (2.7)	0.018*
Cell phone	109 (94.0)	316 (98.4)	425 (97.3)	
Most preferred sites on the internet[§]				
Game	6 (5.2)	5 (1.6)	11 (2.5)	0.001*
News	14 (12.1)	14 (4.4)	28 (6.4)	
Food	1 (0.9)	3 (0.9)	4 (0.9)	
Informative	7 (6.0)	18 (5.6)	25 (5.7)	
Shopping	1 (0.9)	26 (8.1)	27 (6.2)	
Social sharing sites	83 (71.5)	244 (76.0)	327 (74.9)	
Other	4 (3.4)	11 (3.4)	15 (3.4)	
Time to stay on the internet (h/day)	3.4 ± 2.7	3.4 ± 2.3	3.4 ± 2.4	0.720
Time to use computer weekday (h/day) (Mean ± SD)	2.4 ± 3.3	1.0 ± 1.8	1.4 ± 2.4	0.000*
Time to use computer weekend (h/day) (Mean ± SD)	2.9 ± 3.5	1.4 ± 2.2	1.8 ± 2.7	0.000*
Thinking to be a smartphone addiction[§]				
Yes	40 (34.5)	116 (36.1)	156 (35.7)	0.718
No	76 (65.5)	205 (63.9)	281(64.3)	
Purpose of using smartphone[§]				
Voice call	4 (3.4)	13 (4.0)	17 (3.9)	0.002*
Messaging	11 (9.5)	42 (13.2)	53 (12.1)	
Internet	25 (21.6)	101 (31.5)	126 (28.8)	
Social networks	53 (45.7)	143 (44.5)	196 (44.9)	
Entertainment	18 (15.5)	19 (5.9)	37 (8.5)	
Game	5 (4.3)	3 (0.9)	8 (1.8)	
Time to use smartphone (h/day) (Mean ± SD)	5.5 ± 2.9	5.9 ± 2.9	5.8 ± 2.9	0.230

*$p<0.05$, [§]n(%), [β]Mann–Whitney U test and Pearson Chi-square test were used for numerical data and categorical data, respectively

results of Young's Internet Addiction Test showed that 22.4% of males and 9.7% of females were potential internet addiction, and the distinction between males and females was significant ($p<0.05$) (Table 2).

Comparison of some variables according to eating disorder risk

Table 3 compares some anthropometric measurements and

Table 2 Assessment of Eating Behavior Disorder, Smartphone Addiction Test and IAT

	Male $n=116$ (Mean ± SD) (Min–Max)	Female $n=321$ (Mean ± SD) (Min–Max)	Total $n=437$ (Mean ± SD) (Min–Max)	$p^{\S}$
Total score of EAT	15.3 ± 10.1 (3.0–59.0)	18.4 ± 10.8 3.0–66.0)	17.6 ± 10.7 (3.0–66.0)	0.001**
Total score of SAS	89.7 ± 26.0 (39.0–146.0)	88.8 ± 25.7 (34.0–186.0)	89.1 ± 25.8 (34.0–186.0)	0.856
Total score of IAT	34.4 ± 19.3 (5.0–83.0)	28.9 ± 13.6 (4.0–70.0)	30.3 ± 15.5 (4.0–83.0)	0.001**
Presence of internet addiction	*n* (%)	*n* (%)	*n* (%)	
Normal internet user	90 (77.6)	290 (90.3)	380 (87.0)	0.001**
Potential internet addiction	26 (22.4)	31 (9.7)	57 (13.0)	
Risk of eating behavior disorder				
Yes	10 (8.6)	45 (14.0)	55 (12.6)	0.087
No	106 (91.4)	276 (86.0)	382 (87.4)	

SAS Smartphone Addiction Scale, *EAT* Eating Attitudes Test, *IAT* Internet Addiction Test

**$p<0.01$, §Independent Sample *t* Test and Chi-square were used for numerical data and categorical data, respectively

Table 3 Distribution of anthropometric measurements and adiposity according to eating behavior disorder

	Eating behavior disorder		*p*
	Yes $n=55$ Mean ± SD (min–max)	No $n=382$ Mean ± SD (min–max)	
BMI (kg/m^2)	24.4 ± 4.8 (17.3–45.5)	22.1 ± 2.9 (17.0–32.2)	0.000***
Percentage of body fat (%)	28.3 ± 7.5 (14.0–40.4)	24.8 ± 7.1 (6.0–45.8)	0.025*
Amount of body fat (kg)	20.3 ± 9.4 (7.2–51.7)	14.9 ± 5.5 (3.4–38.7)	0.000***
BMR (kcal/day)	1565.2 ± 448.4 (1183.0–2891.0)	1410.2 ± 247.7 (1098.0–2165.0)	0.010*
Percentage of right leg fat (%)	30.6 ± 7.2 (15.7–41.1)	27.7 ± 8.6 (3.7–43.8)	0.102
Percentage of left leg fat (%)	30.6 ± 7.2 (16.5–41.0)	27.8 ± 8.4 (5.1–43.5)	0.107
Percentage of right arm fat (%)	30.7 ± 8.3 (13.9–44.6)	25.9 ± 7.9 (8.5–43.4)	0.006**
Percentage of left arm fat (%)	31.6 ± 8.7 (13.1–43.8)	26.8 ± 7.7 (8.9–44.3)	0.005**
Percentage of internal organ fat (%)	26.1 ± 8.8 (8.7–39.8)	22.1 ± 7.6 (3.0–41.1)	0.017*

Independent Sample t Test was used for tests

BMR basal metabolism rate, *BMI* Body mass index

*$p<0.05$, **$p<0.01$, ***$p<0.0001$

adiposity rates of students with and without eating behavior disorders. Accordingly, students at risk of eating disorder were found to have higher BMI and body fat (kg and %) than other students ($p<0.05$). It was also observed that the amount of fat (%) in the left arm, right arm, and internal organs was also significantly higher in those at risk for eating disorder.

Students being at risk of eating disorder were found to have higher Internet Addiction Test scores (44.0 ± 18.7 and 28.3 ± 14.0, respectively) and Smartphone Addiction Test scores (109.0 ± 23.6 and 86.2 ± 24.8 respectively) than those not being at risk of eating disorder ($p<0.05$). Students being at risk of eating disorder spent 4.2 ± 3.0 h on the internet a day while students not being at risk of eating disorder spent 3.3 ± 2.3 h on the internet a day ($p<0.05$). Duration of using smartphone was similarly higher in students being at risk of eating disorder (6.6 ± 3.1 h/day and 5.6 ± 2.8 h/day, respectively) ($p<0.05$). Students being at risk of eating disorder had significantly higher prevalence of potential internet addiction (36.4% and 9.7%, respectively) than others (Table 4).

Table 4 Distribution of test scores according to eating behavior disorder

	Eating behavior disorder		*p*
	Yes *n* = 55	No *n* = 382	
	Mean ± SD (min–max)	Mean ± SD (min–max)	
Total score of IAT	44.0 ± 18.7 (9.0–80.0)	28.3 ± 14.0 (4.0–83.0)	0.000***
Time to stay on the internet (hour)	4.2 ± 3.0 (1.0–15.0)	3.3 ± 2.3 (1.0–15.0)	0.012*
Time to use computer on the weekday (hour/day)	1.7 ± 2.4 (0–10.0)	1.3 ± 2.4 (0–16.0)	0.323
Time to use computer at the weekend (hour/day)	2.2 ± 3.0 (0–10.0)	1.8 ± 2.7 (0–14.0)	0.247
Total score of SAS	109.0 ± 23.6 (45.0–154.0)	86.2 ± 24.8 (34.0–186.0)	0.000***
How many years to use smartphone	5.5 ± 1.8 (2.0–10.0)	5.4 ± 2.0 (1.0–14.0)	0.758
Duration of using smartphone (hour/day)	6.6 ± 3.1 (1.0–15.0)	5.6 ± 2.8 (1.0–15.0)	0.023*
Presence of internet addiction	*n* (%)	*n* (%)	$p^{\S}$
Potential internet addiction	20 (36.4)	37 (9.7)	0.000***
Normal internet user	35 (63.6)	345 (90.3)	

IAT Internet Addiction Test, *SAS* Smartphone Addiction Scale. Independent Sample *t* test was used for tests

*$p < 0.05$, **$p < 0.01$, ***$p < 0.0001$, §Chi square

Comparison of some variables according to internet addiction risk

Students with potential internet addiction had significantly higher BMI (23.7 ± 5.1 kg/m^2 and 22.2 ± 2.9 kg/m^2, respectively), than the others. However the students' data about adiposity (percentages of body fat, left leg fat, right leg fat, left arm fat, right arm fat, internal organ fat) were not found to be distinct between the groups ($p > 0.05$) (Table 5).

Smartphone Addiction Test scores (115.2 ± 26.3 and 85.1 ± 23.3 respectively) and time to stay on the internet (4.4 ± 2.9 h and 3.2 ± 2.3 h, respectively) higher in students with potential internet addiction than the others. Students with potential internet addiction had significantly higher EAT scores (24.6 ± 14.4 and 16.5 ± 9.6, respectively). Besides, times to use computer weekday and weekend (h/day) were higher in students with potential internet addiction ($p < 0.05$). The grade point averages of students with potential internet addiction were lower than those of students with normal internet users ($p < 0.05$). The duration of using smartphone (h/day) was higher in students with potential internet addiction but was not statistically significant ($p = 0.062$). Times to use computer weekday and weekend (h/day) were significantly higher in students with potential internet addiction ($p < 0.05$) (Table 6).

Correlations analyses between some variables

There was a significant positive correlation between the students' time to stay on the internet and their BMI ($r = 0.137$, $p = 0.004$), EAT Score ($r = 0.107$, $p = 0.025$), Internet Addiction Test Score ($r = 0.297$, $p = 0.000$),

Table 5 Comparison of BMI and adiposity of students according to internet addiction

	Normal internet user *n* = 380	Potential internet addiction *n* = 57	*p*
	Mean ± SD	Mean ± SD	
BMI (kg/m^2)	22.2 ± 2.9	23.7 ± 5.1	0.027*
Amount of body fat (kg)	15.2 ± 5.7	19.4 ± 10.4	0.088
Percentage of body fat (%)	25.1 ± 7.3	26.7 ± 7.4	0.365
Percentage of right leg fat (%)	27.9 ± 8.6	29.9 ± 6.9	0.384
Percentage of left leg fat (%)	28.0 ± 8.4	30.0 ± 6.8	0.373
Percentage of right arm fat (%)	26.4 ± 8.1	27.6 ± 8.0	0.582
Percentage of left arm fat (%)	27.3 ± 7.9	28.7 ± 8.6	0.528
Percentage of internal organ fat (%)	22.4 ± 7.7	24.9 ± 9.4	0.226

BMI Body Mass Index

*$p < 0.05$, Independent Sample *t* test

Table 6 Comparison of some variables of students according to internet addiction

	Normal internet user $n=380$	Potential internet addiction $n=57$	p
	Mean ± SD	Mean ± SD	
Grade point averages	2.9 ± 0.4	2.7 ± 0.4	0.005*
Sleeping duration (h/day)	7.7 ± 1.4	7.9 ± 1.8	0.105
EAT	16.5 ± 9.6	24.6 ± 14.4	0.000*
Time to stay on the internet (h/day)	3.2 ± 2.3	4.4 ± 2.9	0.001**
Duration of using computer on the weekday (h/day)	1.2 ± 2.2	2.6 ± 3.1	0.000***
Duration of using computer at the weekend (h/day)	1.6 ± 2.4	3.7 ± 3.8	0.000***
SAS	85.1 ± 23.3	115.2 ± 26.3	0.000***
How many years to use smartphone (year)	5.3 ± 2.0	5.8 ± 2.2	0.104
Duration of using smartphone (h/day)	5.7 ± 2.8	6.4 ± 3.0	0.062

SAS Smartphone Addiction Scale Score, *EAT* Eating Attitudes Test Score

*$p<0.05$, **$p<0.01$, ****$p<0.0001$, Independent Sample t test

Smartphone Addiction Score ($r=0.280$, $p=0.000$), and percentages of body fat ($r=0.157$, $p=0.026$). Similarly, Internet Addiction Test scores were positively correlated with BMI, EAT, and Smartphone Addiction Test scores ($p<0.05$). In addition, the duration of smartphone usage was linearly correlated with Smartphone Addiction and Internet Addiction Test Scores, and EAT scores ($p<0.05$). It was observed that the Internet and Smartphone Addiction scores of students were negatively correlated with and their grade point averages while their percentages of body fat were positively correlated with BMI and EAT scores. Smartphone Addiction scores were positively correlated with BMI, internet addiction scores and EAT scores (Table 7).

Discussion

Impaired eating behaviors and obesity are clinically diagnosable determinants of eating disorders [23]. This study reveals that the BMI and percentages and amount of body fat (% and kg) of students being at risk of eating disorder were significantly higher than those without eating disorder. Similar studies showed that individuals with overweight were at a higher risk of developing eating disorders when compared to those with healthy body weight [24–26]. In addition, the present study found that EAT scores were higher in females than in males ($p<0.05$). In epidemiological studies, eating disorders have been shown to be more common in females than men [27, 28]. As a result, overweight and obese individuals who are not satisfied with their physical appearance may turn into wrong

Table 7 Relationship of scale scores with each other and some variables

	Duration of smartphone usage (h/day)	Time to stay on the internet (h)	Grade point averages	Percentages of body fat (%)	Total score of SAS	Total score of EAT	Total score of IAT
BMI	− 0.022 $p=0.640$	0.137** $p=0.004$	0.009 $p=0.854$	0.471* $p=0.000$	0.121* $p=0.011$	0.284*** $p=0.000$	0.179*** $p=0.000$
Total score of IAT	0.240*** $p=0.000$	0.297*** $p=0.000$	− 0.156** $p=0.001$	0.042 $p=0.552$	0.665*** $p=0.000$	0.322*** $p=0.000$	
Total score of EAT	0.138** $p=0.004$	0.107* $p=0.025$	− 0.040 $p=0.420$	0.209** $p=0.003$	0.277*** $p=0.000$		
Total score of SAS	0.298*** $p=0.000$	0.280*** $p=0.000$	− 0.169** $p=0.001$	0.087 $p=0.220$			
Percentage of body fat (%)	− 0.091 $p=0.198$	0.157* $p=0.026$	0.115 $p=0.112$				

SAS Smartphone Addiction Scale, *BMI* Body Mass Index, *EAT* Eating Attitude Test, *IAT* Internet Addiction Test

*$p<0.05$, **$p<0.01$, ***$p<0.001$, Spearman correlation analysis was used

feeding habits in order to alter their physical appearance and, ultimately, face with eating disorders. Furthermore, it should be considered that gender plays an active role in the development of eating disorders.

The duration of using the computer on the weekday and weekend was significantly higher in males than in females. Besides, the rate at which males have potential internet addiction was higher than males ($p < 0.05$). Although there are a few studies [29, 30] that assert the contrary, previous studies support this finding [16, 31]. Internet use has been increasing among college students. Tools that access the internet have become indispensable for both males and females due to the fact that the internet meets the needs in various fields such as easy access to the internet, education, entertainment, and shopping through technological advances [29].

This study indicated that 12.6% of students are at risk of eating disorders and 13% are potential internet addiction. It has been observed that students with potential internet addiction had higher times to stay on the internet than those with normal internet users (respectively 4.4 ± 2.9 h/day and 3.2 ± 2.3 h/day, $p = 0.001$). The students with potential internet addiction had higher BMI, and they also higher risk of an eating disorder than those with normal internet users (The prevalence of potential internet addiction was 36.4% in students being at risk of eating disorders and 9.7% in students without eating disorder risk. Eating Attitude Test score was 24.6 ± 14.4 in students with potential internet addiction and 16.5 ± 9.6 in normal internet users.) ($p < 0.05$). As in the present study, there are similar studies showing there is a relationship between internet addiction and eating disorders [14–16]. In addition, Alpaslan et al. [16] reported that individuals with potential internet addiction have significantly higher BMI than those without potential internet addiction, and having a high BMI is a potential risk factor for internet addiction. Eliacik et al. [32] showed that individuals with obesity were at greater risk of internet addiction. Individuals with problematic internet use may not be aware of how much they eat because they are constantly busy with the internet. They can skip meals, or indulge in unhealthy snacks as they are more practical. This act, which is performed unwittingly, may lead to eating problems and harm health in the future. And consequently, undesirable body weight gain and psychological and social problems may occur.

The present study may be the first one to examine the relation between smartphone addiction and eating disorders in college students. This study found that the Smartphone Addiction Test scores were not different by gender. In contrast to similar studies [12, 33], a Korean study found that female participants were more addicted to smartphones than male counterparts, which suggests that there was a difference between genders [34].

When students' durations to use a smartphone were analyzed, it was found that males used 5.5 ± 2.9 h a day and females used 5.9 ± 2.9 h per day. Similarly, Kim et al. [35] also reported that college students used 6.03 ± 4.01 h of smartphone daily. The Smartphone Addiction Test score was correlated linearly with the duration of using the smartphone (h/day) ($r = 0.298$, $p = 0.000$) and internet (h/day) ($r = 0.280$, $p = 0.000$). Besides, the smartphone addiction and internet addiction scores were positively correlated with each other ($r = 0.665$, $p = 000$). Similarly, few other studies found that there was a correlation between internet addiction and smartphone overuse [36, 37]. In addition, there are studies showing that the increase in the frequency of smartphone use and in the time spent on smartphones was closely related to the severity of smartphone addiction [33, 35, 38]. Consequently, educational and preventive measures should be taken in this field, considering that the increase in the time spent on the smartphone and the internet may result in smartphone addiction.

Although there is a study showing that smartphone addiction and BMI are not related to each other [33], a positive but weak relationship was found between Smartphone Addiction Scale scores and students' BMI. Similarly, Vankatesh et al. [39] found that the prevalence of smartphone addiction was higher in overweight and obese individuals. In addition, Zou et al. [40] showed that with the rise in BMI, the rate of smartphone addiction also increased. The number of individuals who reported that they ate faster and had an increase in body weight after they started using a smartphone is substantial [12]. Using a smartphone while eating has been shown to increase energy (15%) and fat consumption in young adults [41]. As the levels of smartphone addiction increased, energy consumed in physical activity and muscle mass decreased but fat mass increased [35]. Closely another study detected that smartphone addiction was positively related with sedentary behavior [42]. Accordingly, unhealthy use of smartphones and smartphone addiction distracts individuals and prevents them from creating awareness of how much they have eaten food and; therefore, may affect their food consumption and preferences. It also increases the rate of fat in the body by reducing the energy spent on physical activity and changing body composition, which ultimately leads to an increase in body weight. Taken all together, smartphone addiction should be considered a possible risk factor for obesity and overweight.

The present study showed to be a positive correlation between smartphone addiction scores and EAT scores ($r = 0.277$, $p = 0.000$). In addition, almost half of the students (44.9%) used their smartphones to access social media. In addition to the various benefits of smartphones that we can access the internet everywhere, they allow young people to communicate more easily with their peers but leave

themselves wide open for comments and criticisms about their physical appearance through the media, which creates more stress and disappointment for them. Individuals use various applications to look more beautiful in social media environments. This obsession with beauty can trigger the development of body dissatisfaction, the desire to keep slim, irregular eating and eating behavior disorders as a result of excessive interest in body shape and social pressure on them to keep slim [43].

The current study has some limitations. Principally we could only assign the relations not the causal connection between variables. Second, this study cannot represent the total population as it is only carried out on college students. In addition, no clinical examination for measurable psychiatric disorders, no standard measure and cutoff score of smartphone addiction, and uneven gender distribution are the other limitations of this study.

The present results show that the time spent on the internet and smartphones can promote addiction to the internet and smartphones. Extreme and addictive use of mobile phone and internet are more likely have sedentary behaviors on physical activity coming out with overweight and obesity [44]. These results also provide evidence that internet and smartphone addiction also can relate the students to develop eating disorders. Therefore, it is extremely important to focus on individuals being at risk for problematic internet use and smartphone addiction today and in the future. In addition, multicenter studies are needed in larger populations to investigate the potential for addiction to smartphones and its relationship to eating disorders.

What is already known on this subject?

Prior studies show the physical health risks related with addictive smartphone usage. Prior studies found that students' addictive smartphone usage may relate with eating and exercise habits and body weight. Further the presence of relationship between eating disorders and internet addiction are already demonstrated in the literature.

What does this study add?

The relation between smartphone addiction and disordered eating behaviors were identified for the first time within this study. Besides, findings of this study promote prior studies indicating that internet addiction increased the risk of developing eating disorders.

Smartphone addiction is associated with both eating disorders and the rise in anthropometric measurements, and it should be taken into account that this addiction threatens health, and appropriate public health interventions should be performed.

Compliance with ethical standards

Conflict of interest Authors declare that there is none conflict of interest.

Ethical approval Written approval form was signed by the students who agreed to participate in the study and Ethical Commission Approval numbered 2019/2 and dated 14.02.2019 was obtained from Gümüşhane University Ethics Commission.

Informed consent All participants provided informed consent prior to their participation.

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